

CLAIMS

What is claimed is:

1. A method of obtaining multiple spatially-heterodyned holograms, comprising:
digitally recording, at a first reference beam-object beam angle, a first spatially-heterodyned hologram including spatial heterodyne fringes for Fourier analysis;
digitally recording, at a second reference beam-object beam angle, a second spatially-heterodyned hologram including spatial heterodyne fringes for Fourier analysis;
Fourier analyzing the recorded first spatially-heterodyned hologram by shifting a first original origin of the recorded first spatially-heterodyned hologram to sit on top of a first spatial-heterodyne carrier frequency defined by the first reference beam-object beam angle;
Fourier analyzing the recorded second spatially-heterodyned hologram by shifting a second original origin of the recorded second spatially-heterodyned hologram to sit on top of a second spatial-heterodyne carrier frequency defined by the second reference beam-object beam angle;
applying a first digital filter to cut off signals around the first original origin and define a first result;
performing a first inverse Fourier transform on the first result;
applying a second digital filter to cut off signals around the second original origin and define a second result; and
performing a second inverse Fourier transform on the second result,
wherein the first reference beam-object beam angle is not equal to the second reference beam-object beam angle and a single digital image includes both the first spatially-heterodyned hologram and the second spatially-heterodyned hologram.
2. The method of claim 1, wherein the spatial heterodyne fringes of the first spatially-heterodyned hologram are substantially orthogonal with respect to the spatial heterodyne fringes of the second spatially-heterodyned hologram.
3. The method of claim 1, wherein a single pixilated detection device is used to digitally record both the first spatially-heterodyned hologram and the second spatially-heterodyned

hologram.

4. The method of claim 3, wherein the single digital image is generated by the single pixilated detection device.
5. The method of claim 1, wherein digitally recording the first spatially-heterodyned hologram is performed substantially simultaneously with digitally recording the second spatially-heterodyned hologram.
6. The method of claim 5, wherein a first reference beam and a first object beam that define the first reference beam-object beam angle are not coherent with respect to a second reference beam and a second object beam that define the second reference beam-object beam angle.
7. The method of claim 1, wherein digitally recording the first spatially-heterodyned hologram is performed before digitally recording the second spatially-heterodyned hologram.
8. The method of claim 7, further comprising changing a path of a reference beam after digitally recording the first spatially-heterodyned hologram and before digitally recording the second spatially-heterodyned hologram.
9. The method of claim 7, further comprising moving a sample that is characterized by both the first spatially-heterodyned hologram and the second spatially-heterodyned hologram after digitally recording the first spatially-heterodyned hologram and before digitally recording the second spatially-heterodyned hologram.
10. The method of claim 1, wherein the first spatially-heterodyned hologram characterizes a first sample and the second spatially-heterodyned hologram characterizes a second sample.
11. An apparatus to obtain multiple spatially-heterodyned holograms, comprising:
 - a source of coherent light energy;
 - a reference beam subassembly optically coupled to the source of coherent light;

an object beam subassembly optically coupled to the source of coherent light;
a beamsplitter optically coupled to both the reference beam subassembly and the object beam subassembly; and

a single pixilated detection device coupled to the beamsplitter that is used to digitally record both a first spatially-heterodyned hologram at a first spatial-heterodyne frequency and a second spatially-heterodyned hologram at a second spatial-heterodyne frequency that is different from the first spatial-heterodyne frequency,

wherein both first spatially-heterodyned hologram and the second spatially-heterodyned hologram are generated substantially at a focal plane of the single pixelated detection device.

12. The apparatus of claim 11, further comprising at least one shutter optically coupled between the reference beam subassembly and the beamsplitter.

13. The apparatus of claim 11, further comprising a reference beam mirror optically coupled to the reference beam subassembly,

wherein i) the reference beam subassembly defines a first reference beam and a second reference beam and ii) the object beam subassembly defines a first object beam and a second object beam.

14. The apparatus of claim 11, wherein the reference beam subassembly does not include a reference beam mirror.

15. The apparatus of claim 11, wherein the reference beam subassembly includes a reference beam illumination lens.

16. The apparatus of claim 11, wherein the source of coherent light energy includes a laser operated in pulse mode.

17. The apparatus of claim 11, wherein the object beam subassembly includes a plurality of individually selectable objective lenses.

18. The apparatus of claim 11, wherein at least one subassembly selected from the group

consisting of the reference beam subassembly and the object beam subassembly includes a spatial filter.

19. The apparatus of claim 11, wherein at least one subassembly selected from the group consisting of the reference beam subassembly and the object beam subassembly includes an acousto-optic modulator.

20. The apparatus of claim 11, wherein at least one subassembly selected from the group consisting of the reference beam subassembly and the object beam subassembly includes a polarizer.